

Assignment 3

AI1110: Probability and Random Variables
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12.13.5.12: Question. Find the probability of throwing at most 2 sixes in 6 throws of a single die.

Answer: $\frac{35}{18}(\frac{5}{6})^4$.

Solution: According to the question:

n	Number of throws	6
p	Probability of getting 6	$\frac{1}{6}$
q	Probability of getting other than 6	$\frac{5}{6}$

TABLE 0: Given Information

Let X: Number of times we get number in 6 throws of a die. Throwing a die and getting 6 or a number other than 6 is a bernoulli event. So, X has a binomial distribution.

$$\Pr(X = k) = P_X(k) = {}^nC_k q^{n-k} p^k \quad (1)$$

$$P_X(k) = {}^6C_k (\frac{5}{6})^{6-k} (\frac{1}{6})^k \quad (2)$$

We are supposed to find probability of throwing at most 2 sixes i.e. $\Pr(X \leq 2)$.

$$\Pr(X \leq 2) = F_X(2) \quad (3)$$

$$= P_X(0) + P_X(1) + P_X(2) \quad (4)$$

Using (2) in (4):

$$= {}^6C_0 (\frac{5}{6})^6 (\frac{1}{6})^0 + {}^6C_1 (\frac{5}{6})^5 (\frac{1}{6})^1 + {}^6C_2 (\frac{5}{6})^4 (\frac{1}{6})^2 \quad (5)$$

$$= (\frac{5}{6})^6 + (\frac{5}{6})^5 + \frac{5}{12} \times (\frac{5}{6})^4 \quad (6)$$

$$= (\frac{5}{6})^4 (\frac{25}{36} + \frac{5}{6} + \frac{5}{12}) \quad (7)$$

$$= (\frac{5}{6})^4 (\frac{70}{36}) \quad (8)$$

$$= \frac{35}{18} (\frac{5}{6})^4 \quad (9)$$

So, the required probability is $\frac{35}{18}(\frac{5}{6})^4$.